Flow Separation Delay on NACA 4415 Airfoil Using Plasma Actuator Effect

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Abstract

Flow separation is a phenomenon that greatly affects the airfoil performance due to adverse pressure gradient. The loss in kinetic energy behind the separated flow region causes undesirable effects, contributing greatly to the increased drag force. In order to overcome this condition, one of the alternative methods is to provide momentum into the fluid in order to counter the adverse pressure gradient thus eliminating the flow separation. This paper discusses the use of plasma actuator located at 0.21 c from leading edge of an airfoil NACA 4415. The investigated areas are the ones of Reynolds numbers 35,000, 100,000, and 200,000. This study uses experimental method. Load cells have been used to obtain aerodynamic force thus the data have been validated from computational methods. In addition, there is also flow visualization in order to understand the flow phenomenon through the testing model. The results of this experimental study show that plasma actuator can increase the value of lift coefficient (CL) and decreasing drag coefficient with the average increase of CL is 24.90%, 7.81% and 1.37%, and also the average decrease is CD is 8.45%, 0.86% and 1.96% in each variation of Reynolds number. The best result is found at Re 35,000 and it is adequate to produce the best separation delay point of 0.0107 c at α = 9°.

Keywords

Separation; Airfoil; Plasma; Reynolds Number

Full Text:

PDF

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